

Chapter 4

Environmental Surveillance

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ENVIRONMENTAL surveillance at the Savannah River Site (SRS) is designed to survey and quantify any effects that routine and nonroutine operations could have on the site and on the surrounding area and population. Site surveillance activities are divided into radiological and nonradiological programs.

As part of the radiological surveillance program, routine surveillance of all radiation exposure pathways is performed on all environmental media that could lead to a measurable annual dose at and beyond the site boundary.

Nonradioactive environmental surveillance at SRS involves the sampling and analysis of surface water, drinking water, sediment, groundwater, and fish. Results from the analyses of surface water, drinking water, sediment, and fish are discussed in this chapter. A description of the groundwater monitoring program analysis results can be found in chapter 6, "Groundwater."

The Environmental Services Section's Environmental Monitoring and Analysis (EMA) group and the Savannah River National Laboratory (SRNL) perform surveillance activities. The Savannah River also is monitored by other groups, including the South Carolina Department of Health and Environmental Control (SCDHEC), the Georgia Department of Natural Resources, and the Academy of Natural Sciences (ANS).

A complete description of the EMA surveillance program, including sample collection and analytical procedures, can be found in section 1105 of the *Savannah River Site Environmental Monitoring Section Plans and Procedures*, WSRC-3Q1-2, Volume 1 (SRS EM Program). Brief summaries of analytical results are presented in this chapter; complete data sets can be found in tables on the CD accompanying this report.

Radiological Surveillance

Air

Description of Surveillance Program

EMA maintains a network of sampling stations in and around SRS to monitor the concentration of tritium and radioactive particulate materials in the air.

Surveillance Results Summary

Except for tritium, specific radionuclides were not routinely detectable at the site perimeter. Both onsite and offsite activity concentrations were similar to levels observed in previous years.

Average gross alpha and beta results were slightly higher in 2004 than in 2003. However, they are consistent with historical results, which demonstrate long-term variability.

No detectable manmade gamma-emitting radionuclides were observed in 2004. These results are consistent with historical results, which indicate only a small number of samples with detectable activity.

Detectable levels of uranium-234 and uranium-238, were observed in all samples in 2004. Also, the SRS Environmental and Bioassay Laboratory (EBL) implemented changes in the method used to determine detectable activity in samples analyzed by alpha spectrometry. This resulted in a greater number of samples indicating detected activity; however, the concentrations of the uranium isotopes were similar to those observed in 2003. Aside from uranium, alpha-emitting radionuclide activity was observed in three samples. Americium-241 was detected at one location on the site perimeter, and curium-244 was detected at two onsite locations. Generally, these

concentrations were consistent with historical results. All isotopes at the remaining locations were below detection levels. As observed in previous years, none of the samples showed strontium-89,90 above their minimum detectable concentration (MDC).

Tritium-in-air results for 2004 were similar to those observed in 2003. Tritium was detected at every sampling location, although not every sample from a particular location had detectable tritium. As in previous years, the Burial Ground North location showed average and maximum concentrations significantly higher than those observed at other locations. This was expected because of its proximity to SRS's tritium facilities, which are near the center of the site. Consistent with the SRS source term, tritium concentrations generally decrease with increasing distance from the tritium facilities.

Rainwater

Description of Surveillance Program

SRS maintains a network of rainwater sampling sites as part of the air surveillance program. These stations are used to measure deposition of radioactive materials.

Surveillance Results Summary

Gamma-Emitting Radionuclides No detectable manmade gamma-emitting radionuclides were observed in rainwater samples in 2004.

Gross alpha and gross beta results from 2004 were consistent with those of 2003. The 2004 gross alpha results generally were slightly higher than those of 2003, while the 2004 gross beta results generally were slightly lower. However, no long-term increasing or decreasing trend was evident, which implies that the observed values are natural background and does not indicate any contribution directly attributable to SRS.

Detectable levels of uranium-234 and uranium-238 were present in most samples. Generally, the uranium concentrations were slightly higher than those observed in 2003. As previously documented, this is the result of changes to the processing of alpha spectrometry results by EBL. Except for plutonium-238 at one location, all other actinides were below detection levels in 2004.

As in 2003, no detectable levels of strontium-89,90 were observed in rainwater samples during 2004.

As in previous years, tritium-in-rain values were highest near the center of the site. This is consistent with the H-Area effluent release points that routinely release

tritium. Tritium was detected at every sampling location, although not every sample from a particular location had detectable tritium. As with tritium in air, concentrations generally decreased as distance from the effluent release point increased.

Gamma Radiation

Description of Surveillance Program

Ambient gamma exposure rates in and around SRS are monitored by a network of thermoluminescent dosimeters (TLDs).

Surveillance Results Summary

Exposures at all TLD monitoring locations show some variation based on normal site-to-site and year-to-year differences in the components of natural ambient gamma exposure levels. Exposure rates varied between 54 and 112 mrem per year.

In general, the 2004 ambient gamma radiation monitoring results indicated gamma exposure rates slightly lower than those observed at the same locations in 2003. However, these results generally are consistent with previously published historical results, and indicate that no significant difference in average exposure rates is observed between monitoring networks—except in the case of population centers, where exposure rates are slightly elevated compared to the other monitoring networks.

E-Area Stormwater Basins

Description of Surveillance Program

Stormwater accumulating in the E-Area stormwater basins is monitored because of potential contamination.

Surveillance Results Summary

There are no active discharges to the E-Area stormwater basins. The primary contributor to basin water is rainwater runoff. Rain events did not supply enough water to the E-03 and E-06 basins for sampling purposes in 2004, when the highest E-Area basin mean tritium concentration was 7.06E+04 pCi/L. This activity was detected in basin E-05 and is attributed to operations at the nearby Four Mile Creek phytoremediation project. The concentration is 45-percent lower than 2003's high mean tritium concentration, which occurred at the same location. Mean cobalt-60, cesium-137, gross alpha, gross beta, and actinides concentrations all were below their respective MDCs.

Site Streams

Description of Surveillance Program

Continuous surveillance is used on several SRS streams to monitor downstream of process areas and to detect and quantify levels of radioactivity in liquid effluents transported to the Savannah River.

Surveillance Results Summary

Based on the past 5 years of data, the tritium concentrations for the five major SRS streams continue to remain constant (Steel Creel and Lower Three Runs) or in a downward trend (Upper Three Runs, Four Mile Creek, and Pen Branch).

No significant concentrations of cobalt-60 and cesium-137 were recorded at the farthest downstream locations on each of the five major SRS streams.

All the stream technetium-99 results were below their MDC. Iodine-129 was detected at one Four Mile Creek location, but the result was barely above its MDC.

Uranium-234 was detected at the farthest downstream sampling points on Steel Creek and Upper Three Runs, but the results were lower than in 2003. Uranium-238 was detected at the final sampling points of Four Mile and Upper Three Runs, and likewise the results were lower than 2003's. The uranium-238 detected at Pen Branch was slightly elevated over the previous five years' results, but was similar to historical values. The strontium-89,90 results recorded at the farthest downstream sampling point of Four Mile Creek continue a downward trend. No actinides were detected at the farthest downstream sampling point of Lower Three Runs.

At the U3R-1A control point location, the gross alpha and beta concentrations were elevated over those of 2003. A 2002 investigation proved inconclusive for rising gross alpha and beta concentrations at the control point, and no offsite activities were identified that would have affected the gross alpha and beta results. Cobalt-60 and cesium-137 concentrations were below their MDCs at U3R-1A in 2004, and all tritium concentrations were below detection.

Gross alpha and beta concentrations also were elevated in four of the five major streams. Upper Three Runs was the stream showing the lowest concentrations.

Seepage Basin and Solid Waste Disposal Facility Radionuclide Migration

To incorporate the migration of radioactivity to site streams into total radioactive release quantities,

EMA monitored and quantified the migration of radioactivity from site seepage basins and the Solid Waste Disposal Facility (SWDF) in 2004 as part of its stream surveillance program. During 2004, tritium, strontium-89,90, technetium-99, and cesium-137 were detected in migration releases. Measured iodine-129 results, however, all were below their MDC. Therefore, the amount of iodine-129 last measured in 1996, using ultra low-level detection methods, was used for dose calculations.

Figure 4-1 is a graphical representation of releases of tritium via migration to site streams for the years 1995-2004. During 2004, the total quantity of tritium migrating from site seepage basins and SWDF was 1,927 Ci, compared to 2,783 Ci in 2003. This decrease is attributed primarily to the decrease in rainfall in 2004, compared to 2003.

Radioactivity previously deposited in the F-Area and H-Area seepage basins and SWDF continues to migrate via the groundwater and to outcrop into Four Mile Creek and into Upper Three Runs.

Measured migration of tritium into Four Mile Creek in 2004 occurred as follows:

- from F-Area seepage basins, 526 Ci—a 5-percent decrease from the 2003 total of 555 Ci
- from H-Area seepage basin 4 and SWDF, 253 Ci—a 35-percent decrease from the 2003 total of 390 Ci
- from H-Area seepage basins 1, 2, and 3, 211 Ci—a 5-percent increase from the 2003 total of 206 Ci

The measured migration from the north side of SWDF and the General Separations Area (GSA) into Upper Three Runs in 2004 was 215 Ci, a 53-percent decrease from the 2003 total of 462 Ci. (The GSA is in the central part of SRS and contains all waste disposal facilities, chemical separations facilities, associated high-level waste storage facilities, and numerous other sources of radioactive material.)

The total amount of strontium-89,90 entering Four Mile Creek from the GSA seepage basins and SWDF during 2004 was estimated to be 91.5 mCi—similar to the 2003 level of 94.1 mCi. Migration releases of strontium-89,90 vary from year to year but have remained below 100 mCi the past 5 years (see data table on CD accompanying this report).

In addition, a total of 29.2 mCi of cesium-137 was estimated to have migrated from the GSA seepage basins and SWDF in 2004. This was a decrease of 58 percent from the 2003 total of 69.8 mCi.

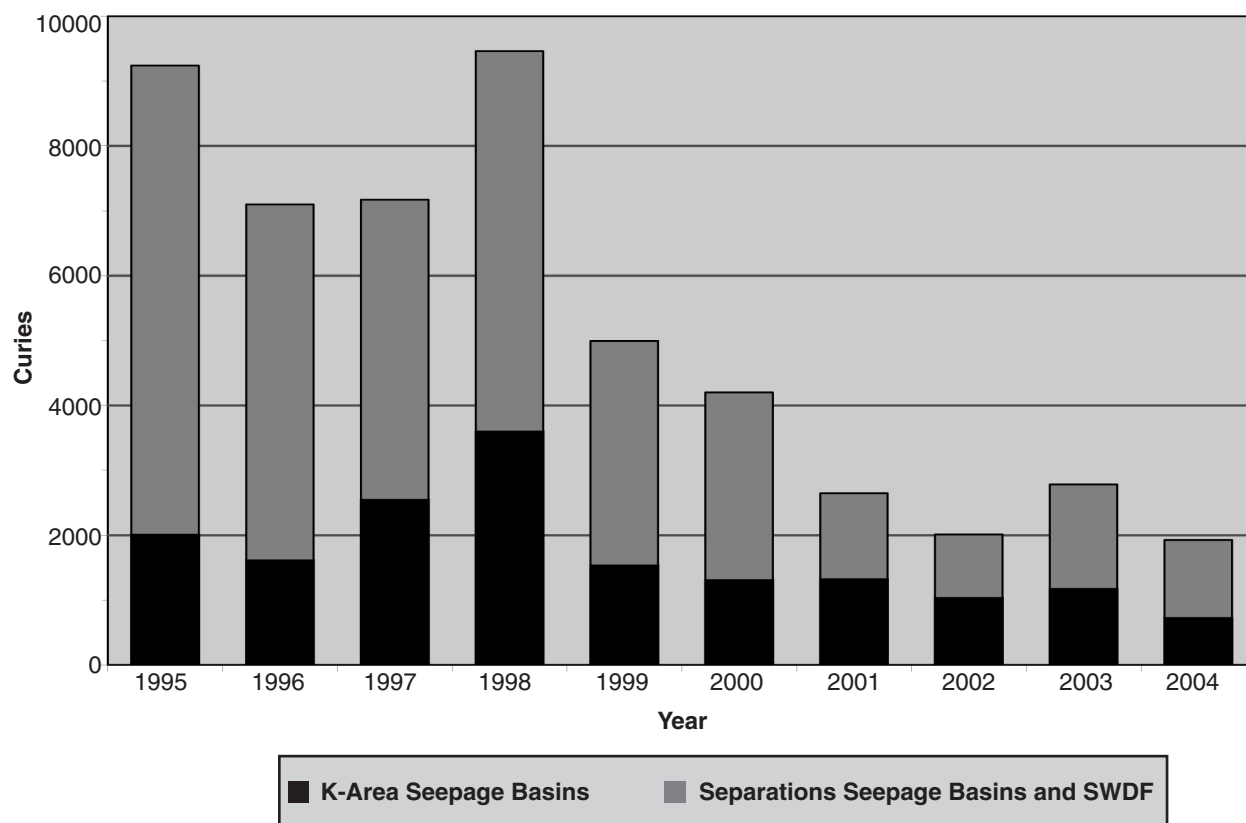


Figure 4–1 Tritium from SRS Seepage Basins and SWDF to Site Streams, 1995–2004

In 2004, 4.86 mCi of technetium-99 was estimated to have migrated into Four Mile Creek. As discussed previously, iodine-129 was not detected in Four Mile Creek during 2004.

K-Area Drain Field and Seepage Basin Liquid purges from the K-Area disassembly basin were released to the K-Area seepage basin in 1959 and 1960. From 1960 until 1992, purges from the K-Area disassembly basin were discharged to a percolation field below the K-Area retention basin. Tritium migration from the seepage basin and the percolation field is measured in Pen Branch. The 2004 migration total of 722 Ci represents a 38-percent decrease from the 1,170 Ci recorded in 2003.

C-Area, L-Area, and P-Area Seepage Basins Liquid purges from the C-Area, L-Area, and P-Area disassembly basins were released periodically to their respective seepage basins from the 1950s until 1970.

Migration releases from these basins no longer are quantified; however, they are accounted for in the stream transport totals.

Transport of Actinides in Streams

Uranium, plutonium, americium, and curium are analyzed annually from each stream location. Values for 2004 were consistent with historical data.

Savannah River

Description of Surveillance Program

Continuous surveillance is performed along the Savannah River at points above and below SRS and includes the point at which liquid discharges from Georgia Power Company's Vogtle Electric Generating Plant enter the river.

Surveillance Results Summary

Tritium is the predominant radionuclide detected above background levels in the Savannah River. The annual mean tritium concentration at RM-118.8 in 2004 was about 3 percent of the drinking water standard.

The average gross alpha concentrations at all river locations were below the representative MDC in 2004.

The average gross beta concentrations were slightly above the representative MDC, but were similar at all locations, indicating that there was no significant release of beta-emitting nuclides attributable to SRS discharges.

Except for tritium, as indicated above, no manmade radionuclides were detected in Savannah River water.

Tritium Transport in Streams

Tritium is introduced into SRS streams and the Savannah River from former production areas on site. Because of the mobility of tritium in water and the quantity of the radionuclide released during the years of SRS operations, a tritium balance has been performed annually since 1960. The balance is evaluated among the following alternative methods of calculation:

- tritium releases from effluent release points and calculated seepage basin and SWDF migration (direct releases)
- tritium transport in SRS streams and the last sampling point before entry into the Savannah River (stream transport)
- tritium transport in the Savannah River downriver of SRS after subtraction of any measured contribution above the site (river transport)

The combined tritium releases in 2004 (direct discharges and migration from seepage basins and SWDF) totaled 2,683 Ci, compared to 4,319 Ci in 2003, a decrease of about 60 percent.

During 2004, the total tritium transport in SRS streams decreased by approximately 33 percent (from 4,139 Ci in 2003 to 2,785 Ci in 2004).

EMA has been conducting a study of tritium flux in Lower Three Runs, including sampling on Lower Three Runs tributaries as well as discussions with Chem-Nuclear Systems, LLC (CNS). The result of this study, supported by both EMA and CNS data, indicated a small but measurable amount of tritium entering the Lower Three Runs system from previous CNS operations. This is expected to decline slowly. EMA and CNS will continue to monitor the Lower Three Runs system.

The 2004 measured tritium transport in the Savannah River (3,630 Ci) was more than the stream transport total. Most of this difference is attributed to Plant Vogtle's 2004 tritium releases, which totaled approximately 1,200 Ci.

SRS tritium transport data for 1960–2004 are depicted in figure 4–2, which shows summaries of the past 45 years of direct releases, stream transport, and river transport, as determined by EMA.

General agreement between the three calculational methods of annual tritium transport—measurements at the source, stream transport, and river transport—serves to validate SRS sampling schemes and counting results. Differences between the various methods can be attributed to uncertainties arising in the collection and analytical processes, including the determination of water flow rates and of varying transport times.

Domestic and Drinking Water

Description of Surveillance Program

EMA collected domestic and drinking water samples in 2004 from locations at SRS and at water treatment facilities that use Savannah River water. Potable water was analyzed at offsite treatment facilities to ensure that SRS operations did not adversely affect the water supply and to provide voluntary assurance that drinking water did not exceed EPA drinking water standards for radionuclides.

Onsite domestic water sampling consisted of quarterly grab samples at large treatment plants in A-Area, D-Area, and K-Area and annual grab samples at wells and small systems. Collected monthly off site were composite samples from

- two water treatment plants downriver of SRS that supply treated Savannah River water to Beaufort and Jasper counties in South Carolina and to Port Wentworth, Georgia
- the North Augusta (South Carolina) Water Treatment Plant

Surveillance Results Summary

All domestic and drinking water samples collected by EMA were screened for gross alpha and gross beta concentrations to determine if activity levels warrant further analysis. No domestic water used for drinking purposes exceeded EPA's 1.50E+01-pCi/L alpha activity limit or 5.00E+01-pCi/L beta activity limit. Also, no onsite or offsite domestic or drinking water samples exceeded the 2.00E+04-pCi/L EPA tritium limit, and no domestic or drinking water samples exceeded the strontium 89,90 MDC.

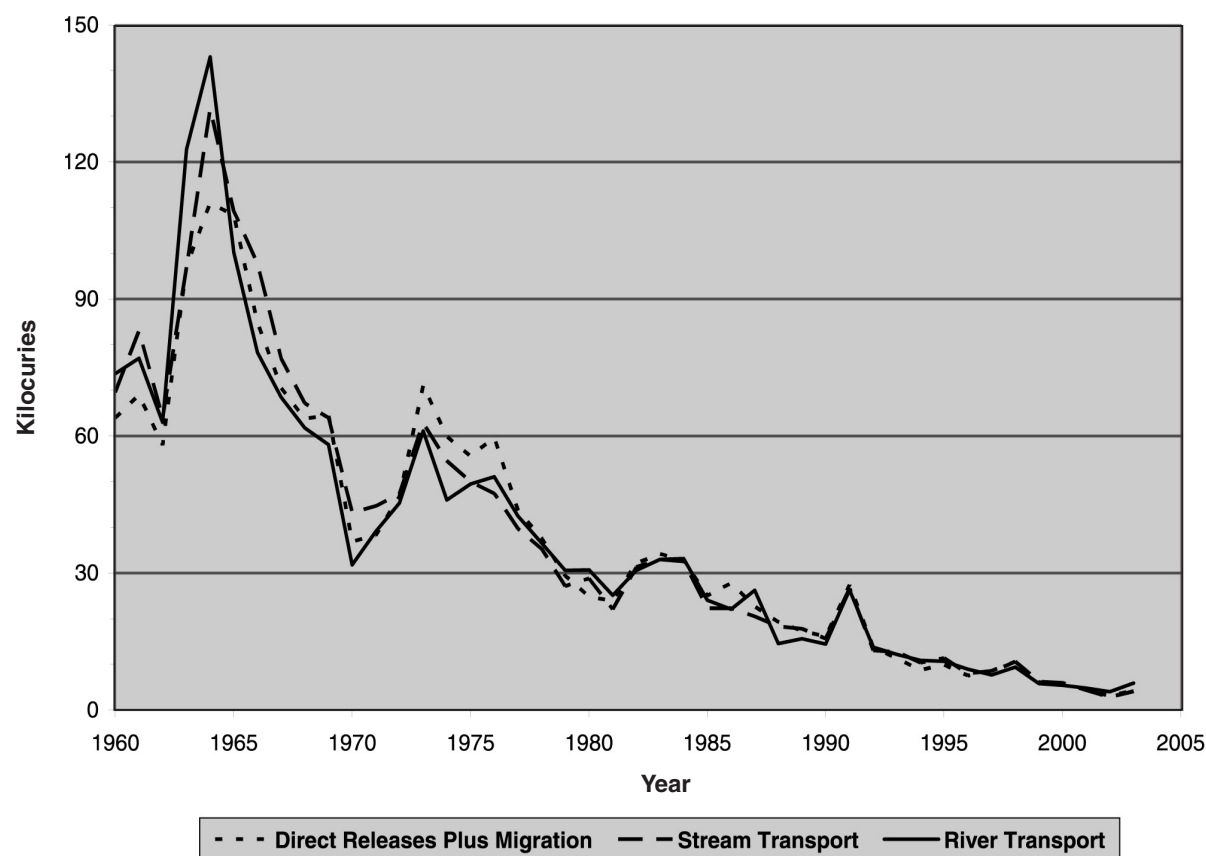


Figure 4–2 SRS Tritium Transport Summary, 1960–2004

SRS has maintained a tritium balance of direct releases plus migration, stream transport, and river transport since 1960 in an effort to account for and trend tritium releases in liquid effluents from the site. The general trend over time is attributable to (1) variations in tritium production at the site (production stopped in the late 1980s); (2) the implementation of effluent controls, such as seepage basins, beginning in the early 1960s; and (3) the continuing depletion and decay of the site's tritium inventory.

No cobalt-60, cesium-137, or plutonium-239 was detected in any domestic or drinking water samples. In general, uranium isotopes, plutonium-238, curium-244, and americium-241 were not detected, although samples from a few locations showed detectable levels of these nuclides.

Terrestrial Food Products

Description of Surveillance Program

The terrestrial food products surveillance program consists of radiological analyses of food product samples typically found in the Central Savannah River Area (CSRA). These food products include meat (beef), fruit, and green vegetables (collards). Data from the food product surveillance program are not used to show direct compliance with any dose standard; however, the data can be used as required to verify dose models and determine environmental trends.

Samples of food—including meat (beef), fruit (melons or peaches), and a green vegetable (collards)—are collected from one location within each of four quadrants and from a control location within an extended (to 25 miles beyond the perimeter) southeast quadrant. All food samples are collected annually except milk.

Food samples are analyzed for the presence of gamma-emitting radionuclides, tritium, strontium-89,90, plutonium-238, and plutonium-239.

Surveillance Results Summary

The only manmade gamma-emitting radionuclide detected in food products in 2004 was cesium-137, which was found in collards from five sampling locations, milk at one location, and fruit at one location. Strontium-89,90 was detected in collards at two locations, while tritium was detected in collards and milk at one location. Plutonium-238 was found

slightly above its MDC in beef at one location. No other manmade radionuclides were detected in food products.

Tritium in milk and other samples is attributed primarily to releases from SRS. Tritium concentrations in collards and milk were similar to those of previous years. No tritium was detected in any other food sample.

These results are similar to those of previous years.

Aquatic Food Products

Description of Surveillance Program

The aquatic food product surveillance program includes fish (freshwater and saltwater) and shellfish. To determine the potential dose and risk to the public from consumption, both types are sampled.

Nine surveillance points for the collection of freshwater fish are located on the Savannah River—from above SRS at Augusta, Georgia, to the coast at Savannah, Georgia.

Surveillance Results Summary

Cesium-137 was the only manmade gamma-emitting radionuclide found in Savannah River edible composites. Strontium-89,90 and tritium were detected at most of the river locations. No manmade radionuclides were detected in saltwater fish or shellfish. These results were similar to those of previous years.

Deer and Hogs

Description of Surveillance Program

Annual hunts, open to members of the general public, are conducted at SRS to control the site's deer and feral hog populations and to reduce animal-vehicle accidents. Before any animal is released to a hunter, EMA uses portable sodium iodide detectors to perform field analysis for cesium-137. Media samples (muscle and/or bone) are collected periodically for laboratory analysis based on a set frequency, on cesium-137 levels, and/or on exposure limit considerations.

Surveillance Results Summary

A total of 817 deer and 213 feral hogs were taken during the 2004 site hunts. As observed during previous hunts, cesium-137 was the only manmade gamma-emitting radionuclide detected during laboratory analysis. Generally, the cesium-137 concentrations measured by the field and lab methods were comparable. Field measurements from all animals ranged from 1 pCi/g to 48.3 pCi/g, while lab measurements ranged from 1 pCi/g to 32.4 pCi/g. The average field cesium-137

concentration was 1.16 pCi/g in deer (with a maximum of 48.3 pCi/g) and 1.21 pCi/g in hogs (with a maximum of 25.1 pCi/g).

Strontium levels are determined in some of the animals analyzed for cesium-137. Typically, muscle and bone samples are collected for analysis from the same animals checked for cesium-137, and the samples are analyzed for strontium-89,90. As in previous years, strontium-89,90 was not quantified in muscle samples. Lab measurements of strontium-89,90 in bone ranged from a high of 4.75 pCi/g to a low of 3.62 pCi/g.

Turkeys/Beavers

Description of Surveillance Programs

Wild turkeys have been trapped on site by the South Carolina Department of Natural Resources and used to repopulate game areas in South Carolina and other states. The U.S. Department of Agriculture Forest Service—Savannah River harvests beavers in selected areas within the SRS perimeter to reduce the beaver population and thereby minimize dam-building activities that can result in flood damage to timber stands, to primary and secondary roads, and to railroad beds. However, both programs continued to remain inactive in 2004 because of reduced needs.

Soil

Description of Surveillance Program

The SRS soil monitoring program provides

- data for long-term trending of radioactivity deposited from the atmosphere (both wet and dry deposition)
- information on the concentrations of radioactive materials in the environment

The concentrations of radionuclides in soil vary greatly among locations because of differences in rainfall patterns and in the mechanics of retention and transport in different types of soils. Because of this program's design, a direct comparison of data from year to year is not appropriate. However, these results may be evaluated over a period of years to determine long-term trends.

Soil samples are collected from four onsite locations, four site perimeter locations and two offsite locations.

Surveillance Results Summary

Radionuclides in soil samples from 2004 were detected as follows:

- cesium-137 at 10 locations (on site/perimeter/offsite)
- uranium-234, 235, and 238 at all locations
- plutonium-238 at 11 onsite, perimeter, and offsite locations
- plutonium-239 at nine locations (onsite/perimeter/off site)
- americium-241 at four onsite and perimeter locations

These results are similar to those of previous years.

Settleable Solids

Description of Surveillance Program

Settleable-solids monitoring in effluent water is required to ensure—in conjunction with routine sediment monitoring—that a long-term buildup of radioactive materials does not occur in stream systems.

DOE limits on radioactivity levels in settleable solids are 5 pCi/g above background for alpha-emitting radionuclides and 50 pCi/g above background for beta/gamma-emitting radionuclides.

Low total suspended solids (TSS) levels result in a small amount of settleable solids, so an accurate measurement of radioactivity levels in settleable solids is impossible. Based on this, an interpretation of the radioactivity-levels-in-settleable-solids requirement was provided to Westinghouse Savannah River Company (WSRC) by DOE in 1995. The interpretation indicated that TSS levels below 40 parts per million (ppm) were considered to be in *de-facto* compliance with the DOE limits.

To determine compliance with these limits, EMA uses TSS results—gathered as part of the routine National Pollutant Discharge Elimination System monitoring program—from outfalls co-located at or near radiological effluent points. If an outfall shows that TSS levels regularly are greater than 40 ppm, a radioactivity-levels-in-settleable-solids program and an increase in sediment monitoring will be implemented.

Surveillance Results Summary

In 2004, one TSS sample exceeded 40 ppm. This result (44 ppm) occurred at Outfall F-01 because of nearby demolition work. The 2004 TSS results indicate that SRS remains in compliance with the DOE radioactivity-levels-in-settleable-solids requirement.

Sediment

Description of Surveillance Program

Sediment sample analysis measures the movement, deposition, and accumulation of long-lived radionuclides in stream beds and in the Savannah River bed.

Significant year-to-year differences may be evident because of the continuous deposition and remobilization occurring in the stream and river beds—or because of slight variation in sampling locations—but the data obtained can be used to observe long-term environmental trends.

Sediment samples were collected at eight Savannah River locations and 13 site stream locations in 2004.

Surveillance Results Summary

Cesium-137 and cobalt-60 were the only manmade gamma-emitting radionuclides observed in river and stream sediments. The highest cesium-137 concentration in streams, $3.70\text{E}+01$ pCi/g, was detected in sediment from R-Canal. The highest level found on the river, $4.35\text{E}-01$ pCi/g, was at River Mile 129; the lowest levels were below detection at several locations. Generally, cesium-137 concentrations were higher in stream sediments than in river sediments. This is to be expected because the streams receive radionuclide-containing liquid effluents from the site. Most radionuclides settle out and deposit on the stream beds or at the streams' entrances to the swamp areas along the river.

Cobalt-60 was detected in sediment from the Four Mile Creek Swamp Discharge and R-Canal locations. The highest cobalt-60 concentration in streams, $7.22\text{E}-02$ pCi/g, was measured at R-Canal.

Strontium-89,90 was detected in sediment at two stream and no river locations. The maximum value was $1.25\text{E}+00$ pCi/g, at FM-A7.

Plutonium-238 was detected in sediment at eight stream locations and one river location during 2004. The maximum value was $3.49\text{E}+00$ pCi/g at FM-A7. to below detection at several locations. Plutonium-239 was detected in sediment at most stream and river locations. The maximum value was $1.82\text{E}-01$ pCi/g—also at FM-A7. Uranium-234, 235, and 238 were detected at all locations.

Concentrations of radionuclides in river sediment during 2004 were similar to those of previous years.

Concentrations of all isotopes generally were higher in streams than in the river. As indicated in the earlier

discussion of cesium-137, this is to be expected. Differences observed when these data are compared to those of previous years probably are attributable to the effects of resuspension and deposition, which occur constantly in sediment media.

Grassy Vegetation

Description of Surveillance Program

The radiological program for grassy vegetation is designed to collect and analyze samples from onsite and offsite locations to determine radionuclide concentrations. Vegetation samples are obtained to complement the soil and sediment samples in order to determine the environmental accumulation of radionuclides and help confirm the dose models used by SRS. Bermuda grass is preferred because of its importance as a pasture grass for dairy herds.

Vegetation samples are obtained from

- locations containing soil radionuclide concentrations that are expected to be higher than normal background levels
- locations receiving water that may have been contaminated

Surveillance Results Summary

Radionuclides in the grassy vegetation samples collected in 2004 were detected as follows:

- tritium at one perimeter location and one onsite location
- cesium-137 (the only manmade gamma-emitting radionuclide detected) at seven perimeter and one offsite location
- strontium-89/90 at 11 locations
- uranium-234 at all locations except Darkhorse, Green Pond, and Patterson Mill Road
- uranium-238 at all locations except Barnwell, Darkhorse, and Patterson Mill Road

These results are similar to those of previous years.

Savannah River Swamp Surveys

Introduction

The Creek Plantation, a privately owned land area located along the Savannah River, borders part of the southern boundary of SRS. In the 1960s, an area of the Savannah River Swamp on Creek Plantation—

specifically, the area between Steel Creek Landing and Little Hell Landing—was contaminated by SRS operations. During high river levels, water from Steel Creek flowed along the lowlands comprising the swamp, resulting in the deposition of radioactive material. SRS studies estimated that a total of approximately 25 Ci of cesium-137 and 1 Ci of cobalt-60 were deposited in the swamp.

Comprehensive and cursory surveys of the swamp have been conducted periodically since 1974. These surveys measure radioactivity levels to determine changes in the amount and/or distribution of radioactivity in the swamp. A series of 10 sampling trails—ranging from 240 to 3,200 feet in length—was established through the swamp. Fifty-two monitoring locations were designated on the trails to allow for continued monitoring at a consistent set of locations.

The 2004 survey was identified as a cursory survey, requiring limited media sampling and analysis—as well as exposure rate measurement. A cursory survey had been scheduled for late 2003 but was canceled because of high water in the swamp.

Analytical Results Summary

The sampling portion of the 2004 survey was conducted from February through June. Because of high water levels, samples could not be obtained from the prescribed locations on three trails (6, 7, and 8), but were obtained from alternate established locations on these trails. Similarly, exposure rate determination via TLDs could not be completed because of high water levels during the measurement period.

As anticipated, based on source term information and historical survey results, cesium-137 was the only manmade gamma-emitting radionuclide detected. Cesium-137 was detected in 39 of the 40 soil samples and eight of the 10 vegetation samples. Cesium-137 concentrations in soil varied from nondetectable to approximately 50 pCi/g, while cesium-137 concentrations in vegetation varied from nondetectable to approximately 11 pCi/g. The observed concentration range is consistent with historical results. In general, higher levels of cesium-137 in soil were observed in the shallow samples. As observed in previous surveys, this vertical distribution profile in soil is not as pronounced as it is in undisturbed areas. This indicates some movement (mobilization, movement, and/or redeposition) of contamination in the swamp. cesium-137 was observed in samples as far as approximately five miles from the site boundary (on trail 10).

Cobalt-60 was not detected in any sample. This is consistent with historical survey results, in which cobalt-60 is detected in low concentrations at a relatively small number of sample sites.

Strontium-90 was detected in two of the 50 soil samples and four vegetation samples. The maximum observed concentration in soil was approximately 0.43 pCi/g, while the maximum concentration in vegetation was approximately 0.75 pCi/g. No correlation was observed between soil and vegetation strontium-90 concentrations or between cesium-137 and strontium-90.

Nonradiological Surveillance

Air

SRS does not conduct onsite surveillance for nonradiological ambient air quality. However, to ensure compliance with SCDHEC air quality regulations and standards, SRNL conducted air dispersion modeling for all site sources of criteria pollutants and toxic air pollutants in 1993. This modeling indicated that all SRS sources were in compliance with air quality regulations and standards. Since that time, additional modeling conducted for new sources of criteria pollutants and toxic air pollutants has demonstrated continued compliance by the site with current applicable regulations and standards. The states of South Carolina and Georgia continue to monitor ambient air quality near the site as part of a network associated with the federal Clean Air Act.

Surface Water

SRS streams and the Savannah River are classified by SCDHEC as “Freshwaters,” which are defined as surface water suitable for

- primary and secondary contact recreation and as a drinking water source after conventional treatment in accordance with SCDHEC requirements
- fishing and survival and propagation of a balanced indigenous aquatic community of fauna and flora
- industrial and agricultural uses

Appendix A, “Applicable Guidelines, Standards, and Regulations,” provides some of the specific guidelines used in water quality surveillance, but because some of these guidelines are not quantifiable, they are not tracked.

Surveillance Results Summary

At every site, most water quality parameters and metals were detected in at least one sample. Thallium and nitrite were not detected in any samples. Only two samples had detectable pesticides/herbicides: one SC-4 sample showed beta-BHC, while one PB-3 sample showed delta-BHC. These results continue to indicate that SRS discharges are not significantly affecting the water quality of the onsite streams or the river.

Drinking Water

Most of the drinking water at SRS is supplied by three systems that have treatment plants in A-Area, D-Area, and K-Area. The site also has 14 small drinking water facilities, each of which serves populations of fewer than 25 persons.

Surveillance Results Summary

All samples collected from SRS drinking water systems during 2004 were in compliance with SCDHEC and EPA water quality standards. Additional information is provided in the Safe Drinking Water Act section of chapter 2, “Environmental Compliance.”

Sediment

The nonradiological sediment surveillance program provides a method to determine the deposition, movement, and accumulation of nonradiological contaminants in stream systems.

Surveillance Results Summary

In 2004, as in the previous five years, no pesticides or herbicides were found to be above the quantitation limits in sediment samples. Metals analyses results for 2004 also were comparable to those of the previous five years.

Fish

EMA personnel analyze the flesh of fish caught from the Savannah River to determine concentrations of mercury in the fish. The fish analyzed represent the most common edible species of fish in the Central Savannah River Area (freshwater) and at the mouth of the Savannah River (saltwater).

Surveillance Results Summary

In 2004, 152 fish were caught from the Savannah River and analyzed for mercury. Concentrations of mercury generally were slightly higher than those observed

in 2003, but were similar to those of previous years. The highest concentrations were found in bass at U.S. Highway 17 (2.31 µg/g), bream at Stokes Bluff (2.49µg/g), and catfish at U.S. Highway 301 (1.71µg/g).

The Academy of Natural Sciences River Water Quality Surveys

Description of Surveys

Academy of Natural Sciences (ANS) personnel conducted biological and water quality surveys of the Savannah River from 1951 through 2003, when the EMA personnel assumed this responsibility. The surveys were designed to assess potential effects of SRS contaminants and warm-water discharges on the

general health of the river and its tributaries. This is accomplished by looking for

- patterns of biological disturbance that are geographically associated with the site
- patterns of change over seasons or years that indicate improving or deteriorating conditions

Samples collected for the 2003 survey were analyzed by ANS during 2004 and compared to previous years' data. No adverse conditions were identified. EMA conducted the macroinvertebrate and diatom sampling during the spring and fall of 2004. The diatom slides were sent to ANS for archiving. EMA personnel archived the spring macroinvertebrate samples on site and are processing the fall samples.